Naval Support Activity Memphis
(formerly Naval Air Station Memphis)
Millington, Tennessee

Fact Sheet 9

This is one in a series of fact sheets informing interested residents about the environmental program at Naval Support Activity (NSA) Memphis. Distribution is coordinated through the NSA Memphis Public Affairs Office at (901) 873-5761.

The Basics of Risk Assessment

April 1997

What is Risk?

Risk, as a technical term, is the potential, based on statistics, for injury, disease, or other harm from specific circumstances.

We experience risk every day. For example, when you drive your car, you are exposing yourself to the risk of an accident. Every time someone participates in a sport, they run the risk of an injury.

While there are precautions that we take, as drivers, to make our driving as safe as possible, we are still exposed to some possibility of an accident when we get behind the wheel and hit the road. And the more often we drive, the greater our possibility of an accident.

Exposure to Risk

Driving a car is what is called a "voluntary" risk. We consciously make the decision to expose ourselves to the dangers of the road. Other voluntary risks include smoking, drinking alcohol, sunbathing, and hang-gliding. If we don't expose ourselves to these situations, the risk associated with them is eliminated.

Other risks are considered "involuntary" risks, and are associated with things we cannot control. For example, the sun's rays can cause skin cancer. This is a risk we cannot eliminate, but we can do things to *minimize* the risk of skin cancer. Wearing sunscreen and a hat will help. On the other hand, sunbathing *increases* the risk of skin cancer from the basic risk that already exists. However, it is a *voluntary* additional risk that some of us choose to take.

Without exposure, there is no risk.

Typically, the risks from environmental hazards are categorized as "involuntary."

Risk Factors

There are two main factors that contribute to environmental risk: Exposure and Toxicity.

Exposure. *Without exposure, there is no risk*

There are two characteristics of exposure:

- **Length or frequency** of exposure can affect the risk. Longer exposure (longer sunbathing) or greater frequency (more frequent car trips) = greater risk.
- **Dosage** is the measurement of exposure. A high dose can be from long exposure to low levels, or short exposure to high levels.

● Toxicity.
Some substances, activities, or situations are more likely to cause harm than others. The tendency for harm is called "toxicity." Summer sunshine at high noon is more "toxic" (more harmful) than winter sunshine.

● In Short...
The dose is combined with the toxicity of the substance to estimate risk. High doses of toxic materials typically cause more harm.

"All substances are poisons.
There is none which is not a poison.
The right dose differentiates a poison from a remedy."
- Paracelsus (1493-1541)

Risk Assessment

● What is it?
Naval Support Activity (NSA) Memphis has several sites where various chemicals, such as pesticides and industrial cleaners, entered the environment. These sites may pose some risk to human health or the environment. In these situations, a risk assessment is completed.

This process evaluates whether there is a risk to human health or the environment *over and above* natural risks from materials at the site. Where there is a risk, it will help decision makers review what measures, if any, are needed to minimize the risk.

A risk assessment is a complex series of calculations based on technical data. The calculations must use certain assumptions that are extremely protective of human health and the environment.

A risk assessment helps the Navy, Tennessee Department of Environment and Conservation, U.S. Environmental Protection Agency (EPA) and other decision-makers decide, with community input, whether, and how to address contamination at NSA Memphis sites.

● Human vs. Ecological Risk
There are two main types of risk assessment: Human Health and Ecological. While the process is basically the same for both types, there are differences that make them difficult to summarize together. Therefore, this fact sheet describes only risk assessment as it relates to human health.

The Four Steps

Risk assessment follows four basic steps in reviewing relative risk at a site.

Four Steps in Risk Assessment
1. Hazard Identification
2. Exposure Assessment
3. Toxicity Assessment
4. Risk Characterization

① HAZARD IDENTIFICATION

This analysis determines what contaminant materials are present, where they are located at the site, and their concentrations. Samples of water and soil — or sometimes air, sediment, plants or animals — are collected and analyzed.

② EXPOSURE ASSESSMENT

This step assesses how, or if, people can come in contact with the materials at the site. Based on the depth of contamination, site location, nearby human activities, ecological information, and other factors, scientists estimate exposure to the materials. Assumptions are used, but they are conservative and *over*estimate exposure. Therefore, they are protective of human health.

People usually come in contact with the materials through the water, soil, air, or food (each of these is a *medium*). Scientists look to see if people can come in contact with the contaminant through each medium.

"Pathways" must exist to have exposure.

If there is the possibility of exposure, the scientists evaluate the types of activities near the site, such as residing, working, playing, or fishing. For each of these, the scientists know if people are exposed and, if so, for roughly how long.

Receptor → Medium → Route
for example:

People are only affected by a material if there is exposure. With detailed knowledge of the type of material and the potential for people to come in contact with it, the scientists can complete an exposure assessment.

◆ In risk assessment, exposure occurs when a "pathway" is completed, and *no exposure means no risk.*

③ TOXICITY ASSESSMENT

Scientists then research the toxicity of materials identified in Step 1. Information is gathered from a central toxicity database maintained by the EPA. This source identifies each material's toxicity and health effects.

Health effects can be grouped into two main categories, cancer-causing (*carcinogenic*) and all others (*non-carcinogenic*).

EPA's database contains information on the cancer-causing potential of carcinogenic substances, and the toxic effects from non-carcinogenic materials.

④ RISK CHARACTERIZATION

The exposure estimates (Step 2) and the toxicity assessment results (Step 3) are matched and combined to estimate the risks from materials at the site. The presence of more than one contaminant at a site may or may not increase the risk. Risks are estimated based on the type of health effect caused by the contaminant(s):

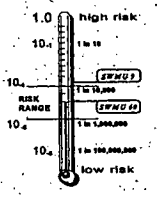
- **Carcinogenic.** Risk is estimated as the chance of contracting some form of cancer *over and above the natural chance (as reported by the American Cancer Society) of 1 in 4.*
- **Non-carcinogenic.** Risk is estimated from the level of exposure compared to threshold levels considered "safe" by the EPA. Levels are usually based on animal studies because few human studies exist. In addition, these levels are many (10 to 10,000) times lower than experimental doses found to be safe in a laboratory setting, and are therefore highly protective.

● Result
Risk estimates from Step 4 are compared to risk ranges considered "acceptable" by the EPA. Risk managers use this comparison to decide what steps, if any, are needed to reduce the risk from the site.

Risk Management Examples

● SWMU 60 – Northside Landfill, NSA Memphis
At this site, contaminants, including petroleum byproducts considered to be carcinogenic, were detected in surface and subsurface soil. Risk assessment showed overall risk from the site to be below EPA's action level, but some of the soil was recommended for removal anyway. Why? Risk managers determined that removing the soil would prevent the possibility of petroleum hydrocarbons in the soil further contaminating the groundwater.

The decision was to remove the soil, despite the risk assessment's finding that the soil contaminants were within EPA's risk range. The decision-makers used the risk assessment as one of several factors in making their decision. EPA's range is where risk management decisions must be made.



EPA's Acceptable Risk Range

● SWMU 9 – Sewage Lagoons, NSA Memphis
Although no fishing is allowed in these ponds, the Navy wanted to know if there could be a health concern for people eating fish caught there. Risk assessment focused on the fish caught from the ponds whose tissue contained the highest levels of contaminants. The assessment determined that there would be additional risk, just above EPA's action level, to someone eating a pound of catfish from this pond every 7 to 10 days for over 30 years (a highly protective scenario). Risk managers agreed that control over fishing was sufficient to protect human health. Therefore, the Navy still will not allow fishing in the lagoons.

This risk management decision was based on the risk assessment's conclusion, but also considered current and future uses of the site, and practicalities like the long-standing ban on fishing in these lagoons.

● Risk Assessment as a Tool for Risk Management
Risk assessment is just one tool used by decision-makers at a site. Other considerations in risk management include:
- future land use (industrial, recreational, commercial, residential)
- public acceptance
- cost

Public Involvement

Restoration Advisory Board

The Restoration Advisory Board is a group of citizens, Navy, city, Tennessee Department of Environment and Conservation, and EPA personnel that meets regularly to discuss progress on the environmental program at the base. These meetings are open to the public and attendance is strongly encouraged.

Information Repository

Information repositories are collections of documents that include work plans, reports, and the Community Relations Plan. These document collections have been established as part of the Navy's program to inform the residents of Millington and surrounding communities about the environmental program at the base. Repositories can be found at two locations, listed to the right.

Mailing List

NSA Memphis also maintains a mailing list of interested organizations and individuals who receive regular updates on the environmental program.

Information Repositories

Shelby County Public Library
Millington Branch
4858 Navy Road
Millington, TN 38053

NSA Memphis Library
South 78 Building
NSA Memphis
Millington, TN 38054

For More Information

If you have any questions about the environmental program, public involvement activities (including Restoration Advisory Board meetings), or would like to be added to the mailing list, please contact the Public Affairs Office at the address or telephone number below.

Public Affairs Office
NSA Memphis
7800 Third Avenue
Millington, TN 38054-5045
(901) 874-5761